Pig-Oriented Equipment Design

- A Nutritionist's Perspective

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John F. Patience, Prairie Swine Centre Inc., Saskatoon, Sask
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Introduction

Animal ethology (behaviour) is increasingly being recognized as more than a "welfare" science. An understanding of pig behaviour provides economically important information on how to best manage the pig, including how to design equipment such as farrowing crates, feeders, drinkers and flooring materials.

In a sense, many people in the pork industry "study' pig behaviour. We watch the pig, interpret its actions as best we can and determine the best solution to related problems. As a nutritionist, I am learning that such intuitive interpretation may not serve me as well as I thought! Among other things, we tend to anthropomorphize, or humanize, the actions of the pig to suit our own experiences and understandings. Ethologists are able to go beyond this level of interpretation and seek answers that may be beyond our own judgments. It is my experience that this new level of understanding has and will continue to serve the pork industry very well.

Feeding behaviour

Feeding behaviour is determined by a multitude of factors. However, in its simplest form, daily food intake will be influenced by three variables:

1. Number of meals per day

2. Food intake per meal (grams)

3. Length of meal (minutes)

Obviously, the same quantity of feed can be consumed by different combinations of meal number and food intake per meal. It is important to remember that food intake per meal is a function of, among other things, feeder design and food presentation.

Given adequate feeder access, pigs demonstrate peaks of intake during the morning and the afternoon, if a diurnal lighting pattern is followed. However, with continuous lighting, the morning and afternoon peaks will blend into a single peak. If feeder access is limiting, pigs will increase "after hours" eating; the impact of this behaviour switch in terms of stress is unknown. It has also been observed that pigs will also change from day-time to night-time eating during hot weather; such a change is not definite nor totally predictable but represents at least a potential behavioural response to environmental stress.

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Eating speed is under the influence of many factors. For example, pigs consume pelleted diets more rapidly than mash; adding water to the mash, but not the pellets, will increase rate of intake. Pigs in larger groups, where feeder access is less, are observed to eat more rapidly than pigs housed individually or in small groups.

Feeder design

In general, it is assumed that a properly adjusted self-feeders will ensure that feed intake will be maximized. In order to manage appetite, producers are advised to adjust barn

temperatures, provide fresh water, avoid overcrowding, provide plenty of feeder space, etc. These are all important issues, but they ignore the central role of the feeder, and the impact it may have on feed intake.

For example, a study currently underway at the Prairie Swine Centre is showing that wet/dry feeders result in growth rates that are 5% higher than on dry feeders; in this experiment, 12 different feeders - half dry and half wet or dry - are being evaluated under identical conditions. The role of feeder design must not be ignored in the management of any feeding program.

Feeder places

The number of pigs allowed per feeder place is a common topic of discussion. "Thumb rules" such as one feeder place per 10 pigs is quite inadequate under practical circumstances. One feeder space is not equivalent to one feeder @ce! What this means is that one feeder hole should not be considered one feeding place. Feeding space is dictated by a number of factors, one of which is the width of the pig; if the feeder holes are too close together, they quite obviously cannot accommodate one pig per hole.

One feeder place must be at least equivalent to the width of the pig at the shoulder. British research has found that this can best be described by the equation

W = 61 X BW 0.33

where W is the width of the pig at the shoulder, expressed in mm and BW is the weight of the pig expressed in kilograms. Table 1 summarizes shoulder widths for pigs of various bodyweights using this method.

Danish scientists, using an admittedly smaller dataset found the following equation to provide the best estimate of shoulder width

W = 54 X BW 0.3753

Table 1. Shoulder width of pigs based on bodyweight (British method)

Body weight, kg	Width, mm	Width, inc.	Body weight, kg	Width, mm	Width, in.
10	130	5.1	60	236	9.3
20	164	6.5	70	248	9.8
30	187	7.4	80	259	10.2
40	206	8.1	90	269	10.6
50	222	8.7	100	279	11.0

Table 2 summarizes shoulder,widths for pigs using this method.

One would be advised to provide a 10% margin to address individual variation, so that a 100 kg might require some 335 mm or 13.2" of feeder space per pig.

Table 2. Shoulder width of pigs based on bodyweight (Danish method)

Body weight, kg	Width, mm	Width, inc.	Body weight, kg	Width, mm	Width, in.
10	128	5.0	60	251	9.9
20	166	6.5	70	266	10.5
30	194	7.6	80	280	11.0
40	216	8.5	90	292	11.5
50	234	9.2	100	304	12.0

Feed wastage

Feed wastage is quite definitely influenced by feeder design; however, the design that minimizes wastage may differ between mash and pelleted diets. It is quite clear that feeders which provide easy access to the feed, and do not force the pig to twist its head or body to eat will result in less wastage. Head and shoulder barriers also reduce wastage by minimizing aggressive behaviour; every time a pig removes its head from the feed hopper, the chance for feed wastage is increased.

Because feeding behaviour and drinking are closely linked, the position of the drinker relative to the feeder will impact feed wastage. Proof of this point is easily obtained by looking under the nipple drinker and seeing the accumulated feed located there.

Aggression

It came as a surprise, to me at least, that more than 80% of the aggressive behaviour which occurs in the feeder barn is related to eating behaviours! Thus, the design of the feeder has the potential to greatly increase or decrease fighting and other aggressive behaviours during the growout period.

Interestingly, most of the aggression related to feeding is initiated by the pig in the process of eating and is very rarely initiated by the pig waiting to gain access to the feeder. This is due to the fact that feed is considered an important resource to the pig and it will protect this resource against intruders. Because the eating pig is normally the aggressor, the current logic is to provide a head and shoulder barrier which avoids visual contact with other pigs in the pen; the result is suggested to be more rapid food intake, less fighting and less wastage. This hypothesis is currently being tested at the Prairie Swine Centre.

Feed access

AR feeders are not equal when it comes to ease of feed access. Even within feeders, adjustments, if available, will have a profound impact on ad libitum feed intake. Some experiments have found that feed intake varies by as much as 70% depending on feeder adjustment.

These same experiments have found that increased ease of access may lead to increased wastage. Therefore, it is important to select an adjustment for a given feeder that optimizes feed intake while keeping wastage under control.

Pigs will eat most rapidly when they can access feed directly in front of them. When this occurs, they move their head very little, but use their tongues a lot. If the feeder space is poorly designed, so that access is impaired, one may see pigs twisting their heads and/or bodies to gain better access to the feed within the feeder. When this occurs, the rate of feed intake declines, wastage increases, and in the case of multiple space feeders, fewer pigs are able to eat due to blockage by the bodies of pigs already eating.

It should also be noted that pigs apparently prefer to eat with the feeder at floor level or a few centimeters above floor level.

Conclusions

The proper feeding of pigs goes far beyond diet formulation. Presentation is also important, so that an understanding of the factors which affect feeding behaviour is important to overall success. Access to the feeder and design and placement of the feeder are two particularly important variables that are under the control of the pork producer. In addition, the relationship between form of the diet, access to water and visual separation from other pigs in the pen need to be considered. Further information on this important topic will be forthcoming as we recognize the importance of feeding behaviour in our overall management systems.

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